Pyroclastic Rock

Pyroclastic Rock:
Consist of volcano materials, which characterize with the presence of pyroclastic material dominantly (glass, crystal, volcanic rock), angular granular, and relative high porosity.

Epiclastic Rock :
Resulted from reworked of volcanic rock or other rocks, which consist of material reworked from volcanic rock (crystal, rock fragment) and non volcanic material.

Volcanoclastic Rock:
Consist of volcanic material (from reworked material or not)
Example; pyroclastic rock, tuff, sediment volcanic such as volcanic sandstone.

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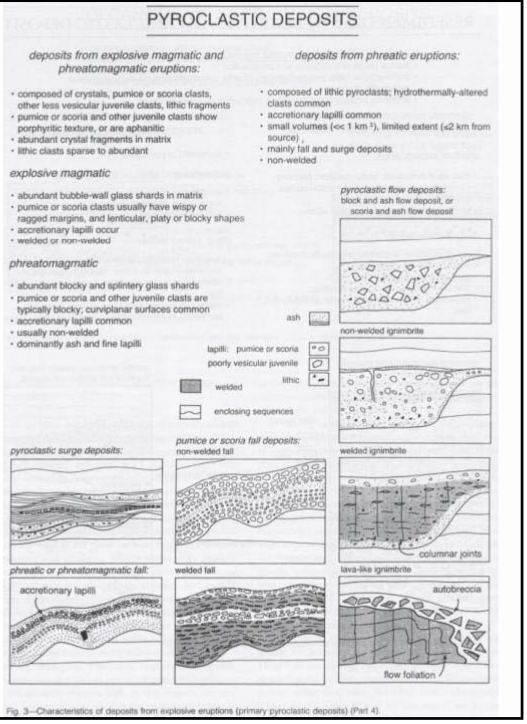
Characteristic of Pyroclastic deposits



PYROCLASTIC DEPOSITS

deposits from explosive magmatic and phreatomagmatic eruptions:

- composed of crystals, pumice or scoria clasts, other less vesicular juvenile clasts, lithic fragments
- pumice or scoria and other juvenile clasts show porphyritic texture, or are aphanitic
- abundant crystal fragments in matrix
- lithic clasts sparse to abundant

explosive magmatic

- abundant bubble-wall glass shards in matrix
- pumice or scoria clasts usually have wispy or ragged margins, and lenticular, platy or blocky shapes
- accretionary lapilli occur
- welded or non-welded

phreatomagmatic

- abundant blocky and splintery glass shards
- pumice or scoria and other juvenile clasts are typically blocky; curviplanar surfaces common
- accretionary lapilli common
- usually non-welded
- dominantly ash and fine lapilli

deposits from phreatic eruptions:

- composed of lithic pyroclasts; hydrothermally-altered clasts common
- accretionary lapilli common
- small volumes (<< 1 km ³), limited extent (≤2 km from source)
- mainly fall and surge deposits
- non-welded

pyroclastic flow deposits:
block and ash flow deposit, or scoria and ash flow deposit
ash
non-welded ignimbrite
lapilli: pumice or scoria
poorly vesicular juvenile
lithic
welded
enclosing sequences
pyroclastic surge deposits:
pumice or scoria fall deposits:
non-welded fall
welded ignimbrite
columnar joints
phreatic or phreatomagmatic fall:
accretionary lapilli
welded fall
lava-like ignimbrite
autobreccia
flow foliation

Fig. 3—Characteristics of deposits from explosive eruptions (primary pyroclastic deposits) (Part 4).

Type of pyroclastic deposits (based on genesis classification)

1. *Pyroclastic fall deposits*

resulted from volcanic matrial of explosion eruption from volcanic hole to the atmosphere and fall again into ground and gather in volcano areas.

Generally this type of deposits thin and fines grain, which fining systematically far from eruption center, the distribution follow the topographic, well sorting, normal and reverse graded bedding, composition: pumice, scoria, ash, litlle lapilli and lithic fragment.

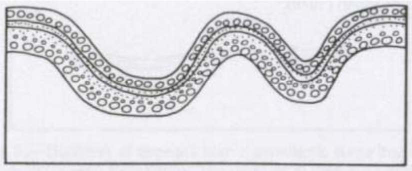


Fig. 58—Geometry of subaerial deposits generated by fallout from eruption clouds. Fallout deposits mantle underlying topography, and are relatively well sorted and bedded (cf. pyroclastic flow deposits). Modified from Wright et al. (1980).

Geometry of

pyroclastic fall deposits

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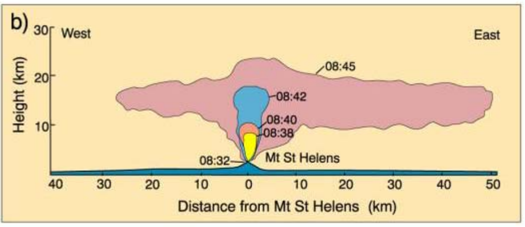
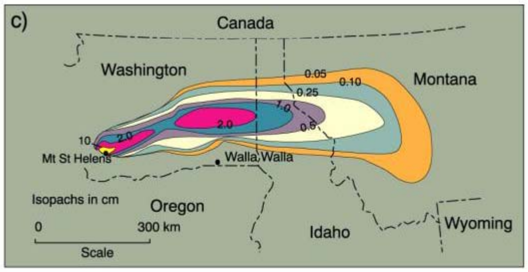
Ash falls : Mt. St. Helens

Photo of Mt. St. Helens vertical ash column, May 18, 1980 (USGS).



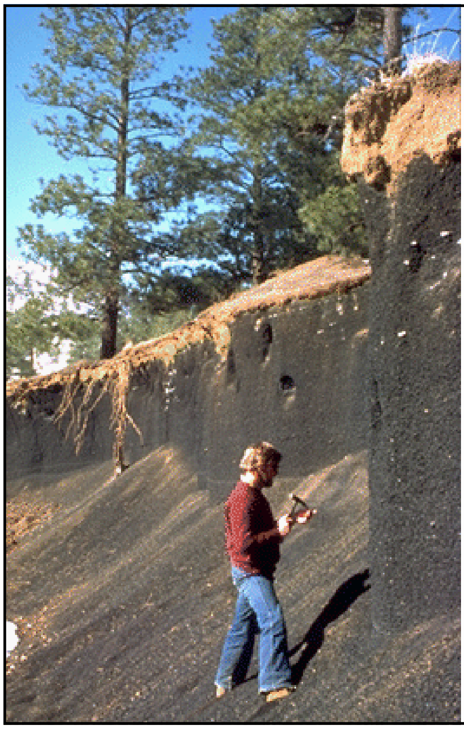
Vertical section of the ash cloud showing temporal development during first 13 minutes.



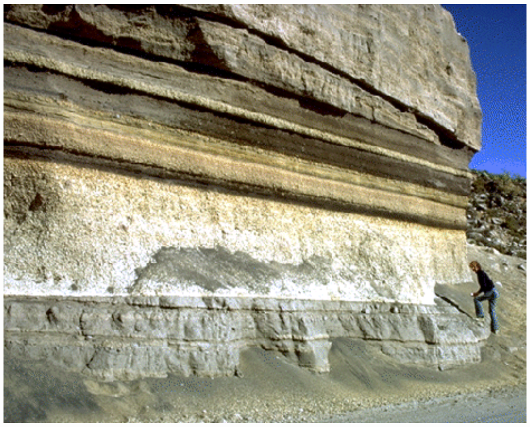
Pyroclastic Fall Deposit

Tephra deposits genesis classification:

- **Scoria-fall deposits** -- These are derived from *Strombolian eruptions* of *scoria cones*. The deposit is composed of basaltic to andesitic vesiculated pyroclasts (scoria) lying near the eruptive vent.
- **Pumice-fall deposits** -- These are derived from *Plinian eruptions* of *stratovolcanoes*. The deposit is composed of highly vesiculated dacitic to rhyolitic pyroclasts (pumice) which can be destributed for hundreds of square kilometers away from the vent.



Strombolian scoria-fall deposit -- Airfall deposits of basalt scoria are typical of Strombolian eruptions. The deposit shown here is from Bandera, New Mexico. It is composed of lapilli-size scoria fragments which have a cindery appearance with a light, frothy texture. The pyroclasts are sharp and angular. The deposit is very near the scoria cone from which it erupted. Typically, scoria-fall deposits are localized in this manner because of the low height of the Strombolian eruptive column, which is generally only a few hundred meters above the vent. Courtesy of Peter Francis.



Plinian pumice-fall deposit -- The white layer in the middle of the outcrop is a two-meter-think deposit composed of pumice lapilli (1-2 cm in diameter) in Arequipa, Peru. This deposit mantles an area of many hundreds of square miles. This large areal extent is typical of *Plinian airfall* which is derived from high eruptive columns, often reaching altitudes in excess of 30 km. The pumice-fall deposit is overlain by other airfall deposits of variable compositions, the darker layers being more *mafic* than the lighter layers. The age of the Plinian deposit is unknown. *Courtesy of Peter Francis.*

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2. *Pyroclastic flow deposits*,

The lateral flow from pyroclastic materials on fluid matrix (gas or liquid or hot liquid) which resulted from volcanic eruption, this volcanic material being transport far from the volcano.

Normally this type of deposit has poor sorting, normal graded bedding of lithic fragment and solid lithic grain which decrese from the eruption center, angular granule and the distribution not equal and thick on the velley/depresion area.

A ***pyroclastic flow*** is a fluidized mixture of solid to semi-solid fragments and hot, expanding gases that flows down the flank of a volcanic edifice. These awesome features are heavier-than-air emulsions that move much like a snow avalanche, except that they are fiercely hot, contain toxic gases, and move at phenomenal, hurricane-force speeds, often over 100 km/hour. They are the ***most deadly of all volcanic phenomena.***

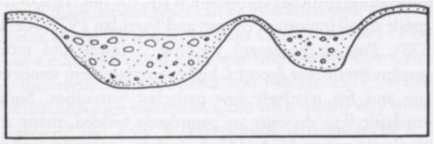

Fig. 43—Geometry of a subaerial pyroclastic flow deposit emplaced on uneven topography. The deposits infill valleys (valley pond deposits) and may also thinly drape topographic highs (ignimbrite veneer deposit, or overbank deposit). Modified from Wright et al. (1980).

Geometry of pyroclastic flow deposits

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Types of pyroclastic flow deposits :

1. Block and Ash Flow Deposits (NUÉE ARDENTES) : consist of vesiculer lapilli and ash, often associate with lava domes or lava flows rhyolitic, dacitic, andesitic, and especially on volcanoes composite and caldera area.

NUÉE ARDENTES : pyroclastic flow contain dense lava fragments derived from the collapse of a growing lava *dome* or *dome flow*.
A *nuée ardente deposit* is called a ***block-and-ash*** deposit

2. Scoria and Ash Flow Deposits : scoria lava with andesitic and basaltic dominant.

3. Pumice and Ash Flow Deposits (PUMICE FLOWS): majority consist of Lapili pumice and blocks, and glass shards, with composition dacitic and rhyolitic.

PUMICE FLOWS : pumice-rich pyroclastic flows contain *vesiculated*, low-density *pumice* derived from the collapse of an eruption column.
A *pumice flow deposit* is called an *ignimbrite*.

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Pyroclastic flow mechanisms

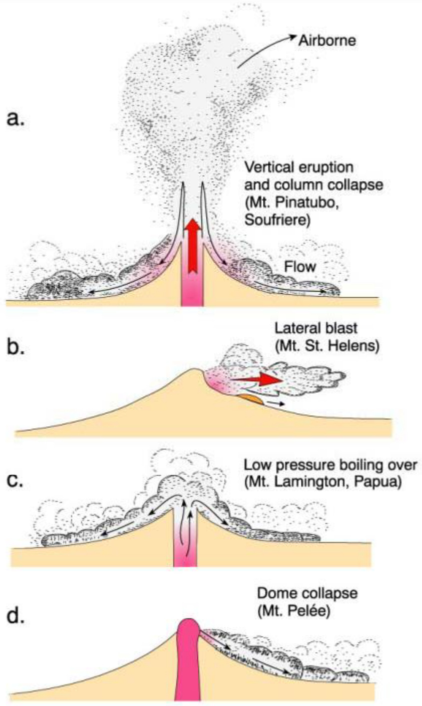
Types of pyroclastic flow deposits. After MacDonald (1972) and Fisher and Schminke (1984).

a. collapse of a vertical explosive or plinian column that falls back to earth, and continues to travel along the ground surface.

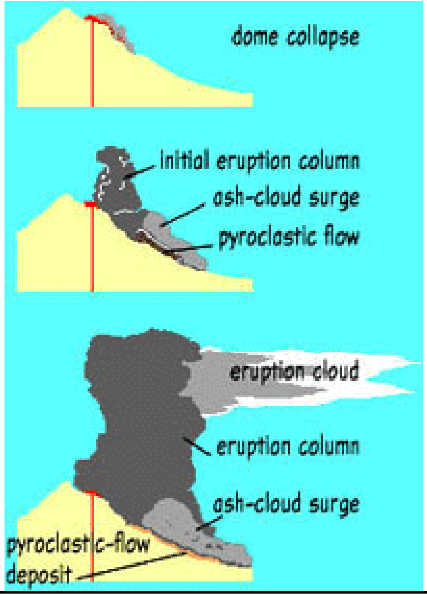
b. Lateral blast, such as occurred at Mt. St. Helens in 1980.

c. “Boiling-over” of a highly gas-charged magma from a vent.

d. Gravitational collapse of a hot dome (Fig. 4-18d).


Airborne
a.
Vertical eruption and column collapse (Mt. Pinatubo, Soufriere)
Flow
b.
Lateral blast (Mt. St. Helens)
c.
Low pressure boiling over (Mt. Lamington, Papua)
d.
Dome collapse (Mt. Pelée)

NUÉE ARDENTES



Mt. Unzen nuée ardentes -- The diagram here demonstrates the sequence of events associated with the 1991-95 nuée ardente eruptions from Mt. Unzen, Japan. Collapse of a growing lava dome generates the nuée ardente. Within seconds a faster-moving cloud of smaller ash-sized fragments (the ***ash-cloud surge***) forms above and in front of the nuée ardente. In some cases, dome collapse is attributed to explosive eruption at the summit crater. Explosive collapse may clear the throat of the volcano, thus generating vertical eruption columns.

Over a four-year period, hundreds of nuée ardentes erupted from Mt. Unzen's summit area. Many of these swept down the populated Mizunashi River valley displacing thousands of people and destroying several hundred homes and precious farmland.

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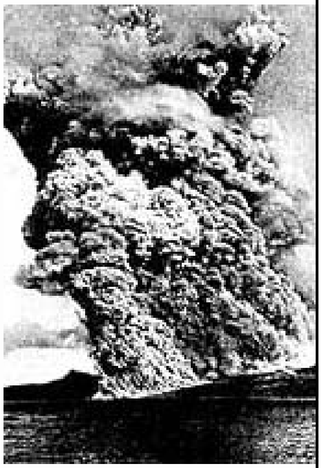
Pyroclastic flow
Mt. Augustine (1996)

Pyroclastic flow
Mt. St. Helens (1980)



Pyroclastic flow
Mt. Pelée (1902)

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